The SHFE Big Picture

Why, What, How, Who, When, Where

Brian Peacock

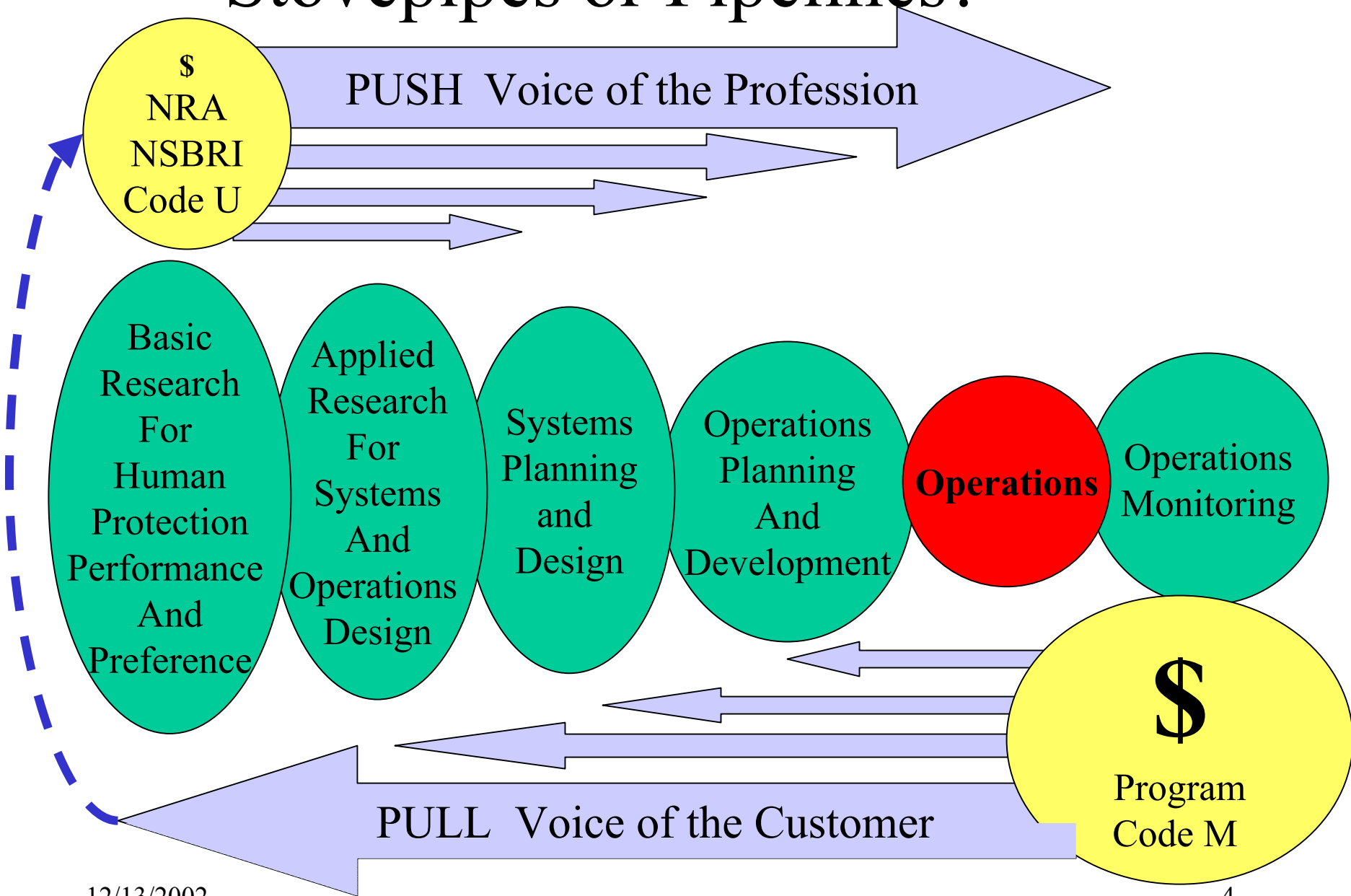
November 2001

The International Space Station

When

- We participate before, during and after missions:
  - **Before** the mission we carry out analyses and make predictions that lead to engineering and operational design decisions, we evaluate these decisions in as much detail as possible
  - **During** the missions we monitor conditions, human participants, activities and outcomes
  - **After** the mission we participate in extensive debriefing activity
  - **Long before** the mission we carry out research and development activity that is likely to have relevance to the space program

Stovepipes or Pipelines?



This bus goes to Mars via the ISS and the Moon

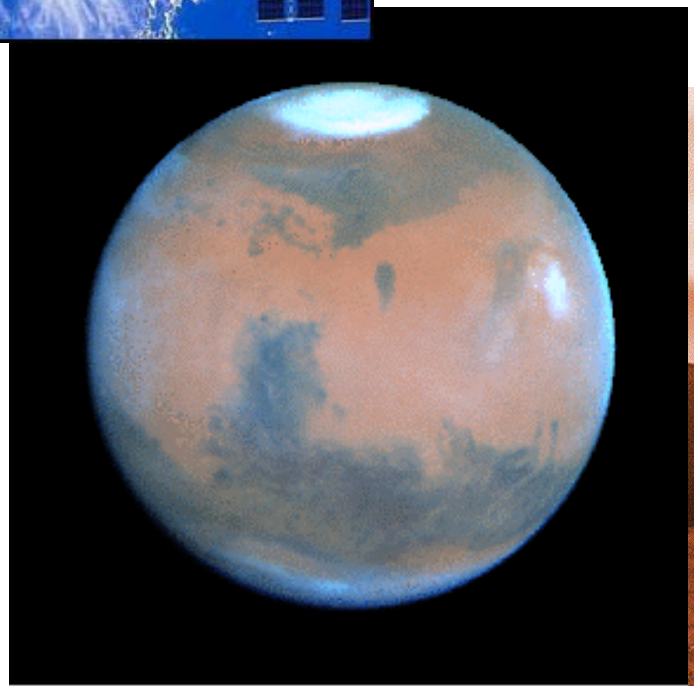
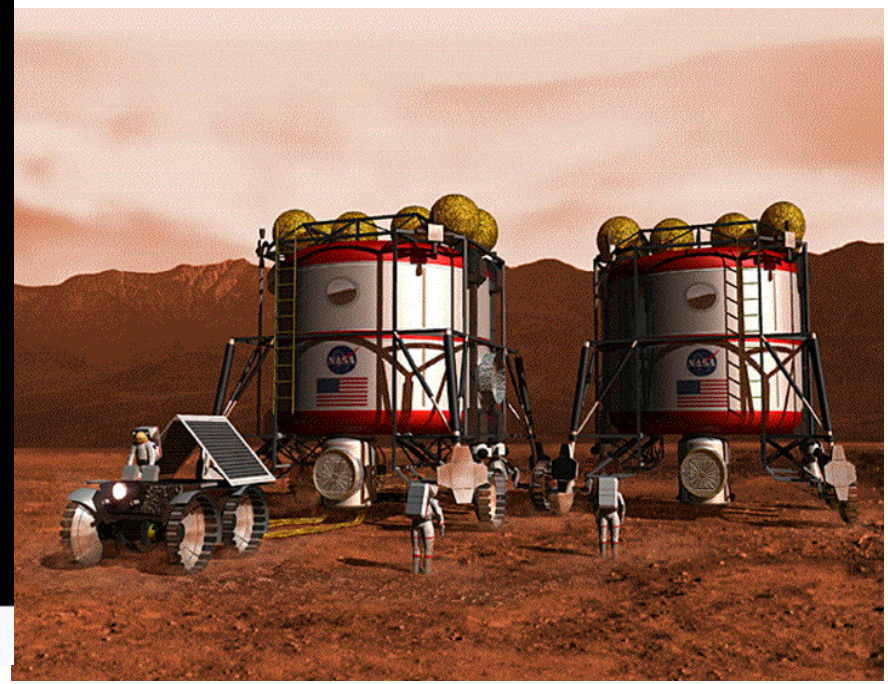
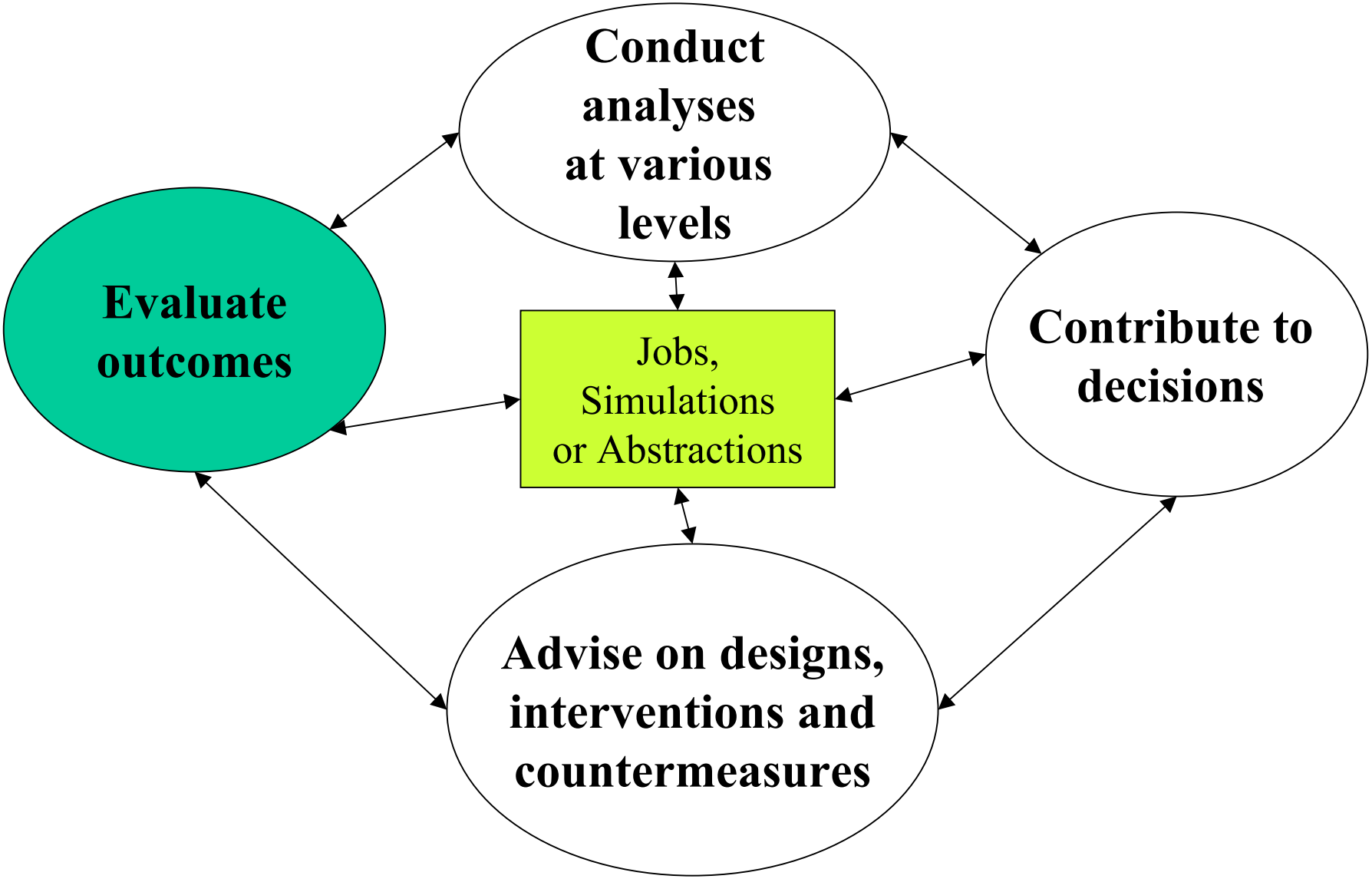


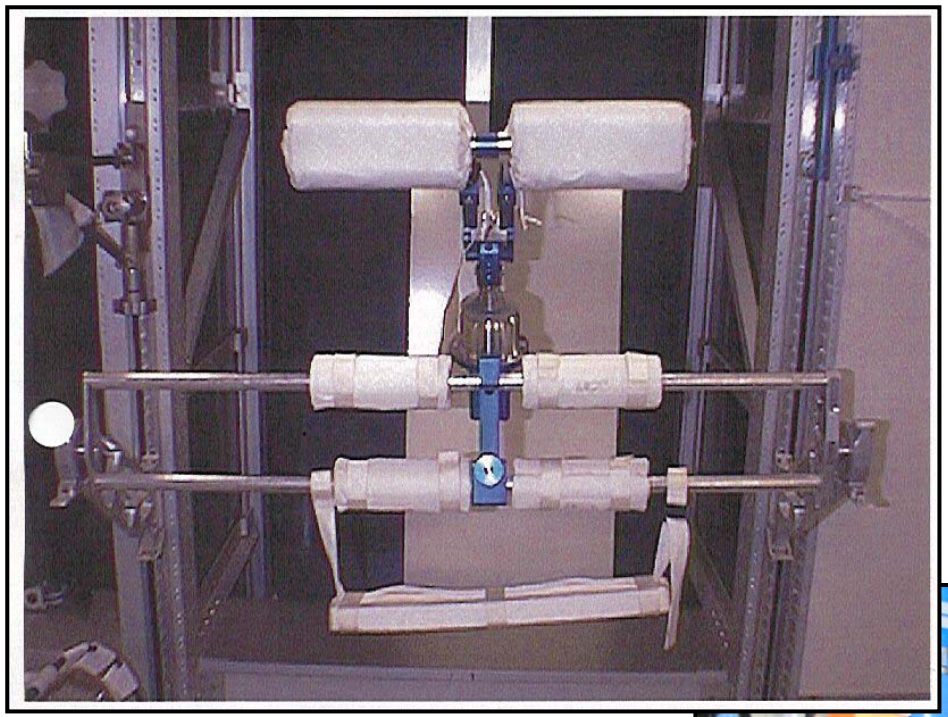
Figure 1. Mars seen from Earth orbit.



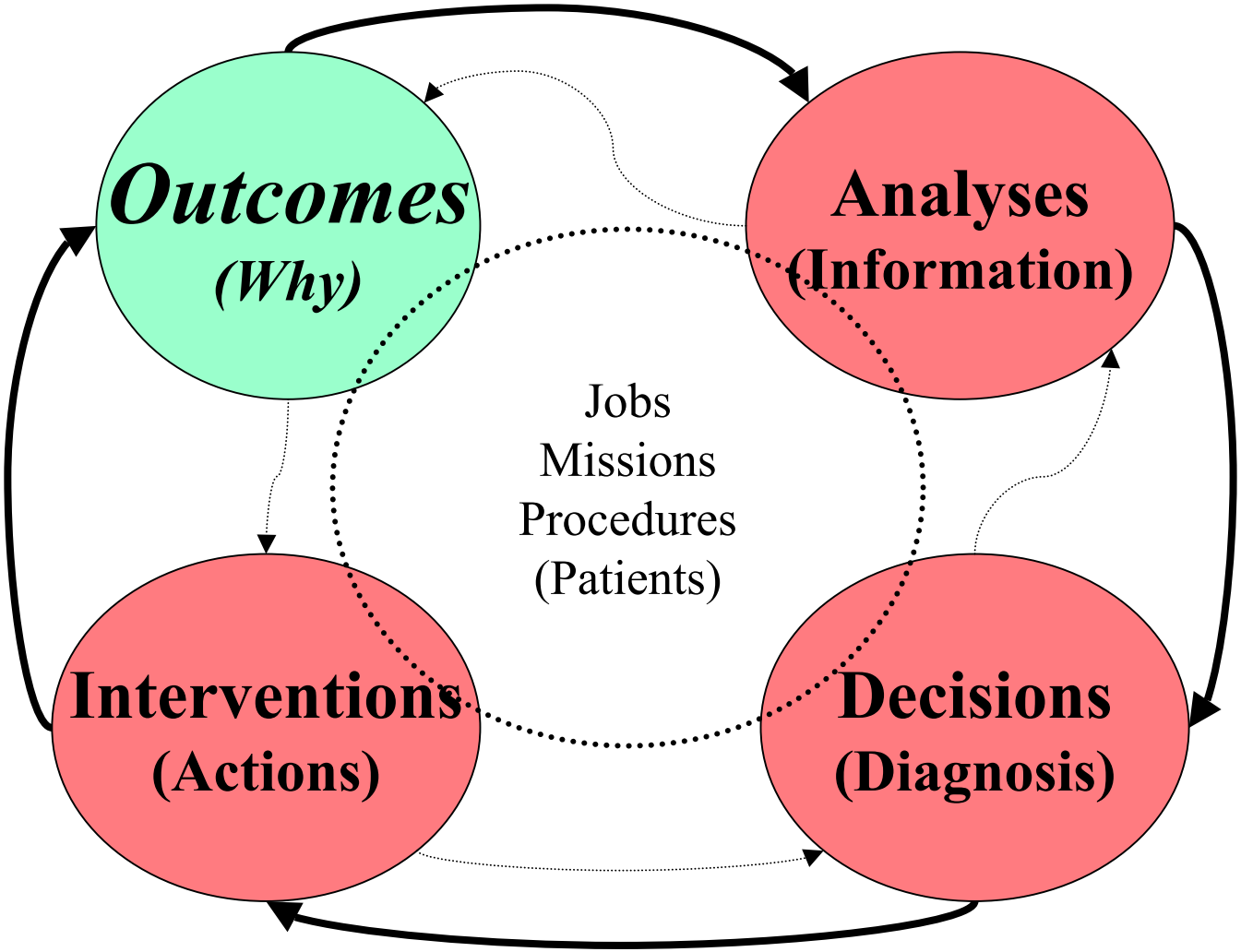
What Do We Do?


Conduct analyses at various levels
Evaluate outcomes
Jobs, Simulations or Abstractions
Contribute to decisions
Advise on designs, interventions and countermeasures

Mobility and Stability Aids



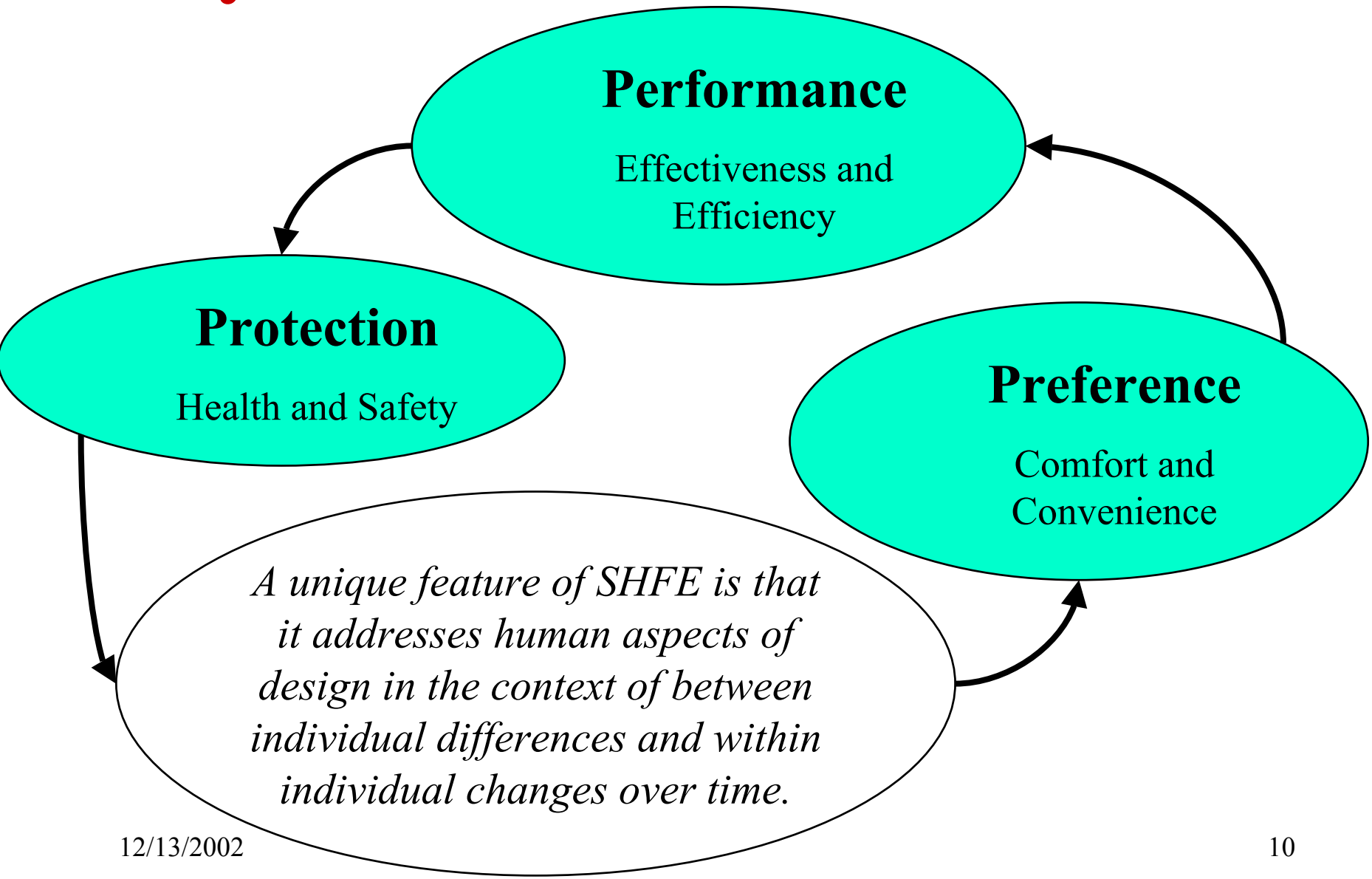
Another Way of Describing the **Whats**



We try not to behave like people with a limited set of actions, who choose a diagnosis to suit those actions and then seek evidence to justify the diagnosis – (like some doctors!)

Congestion

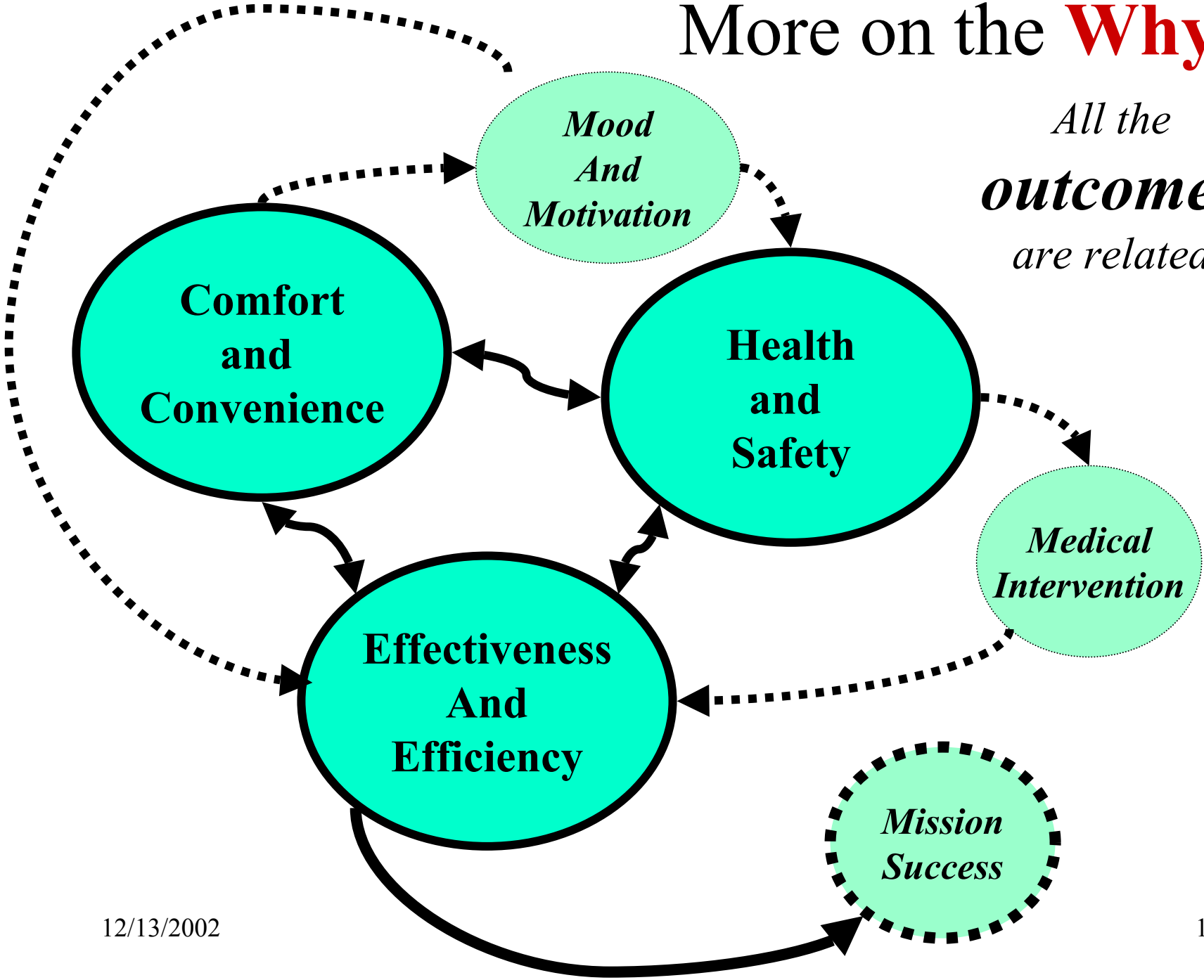
Why is SHFE Useful? - **Outcomes**



Controlling the "Arm"

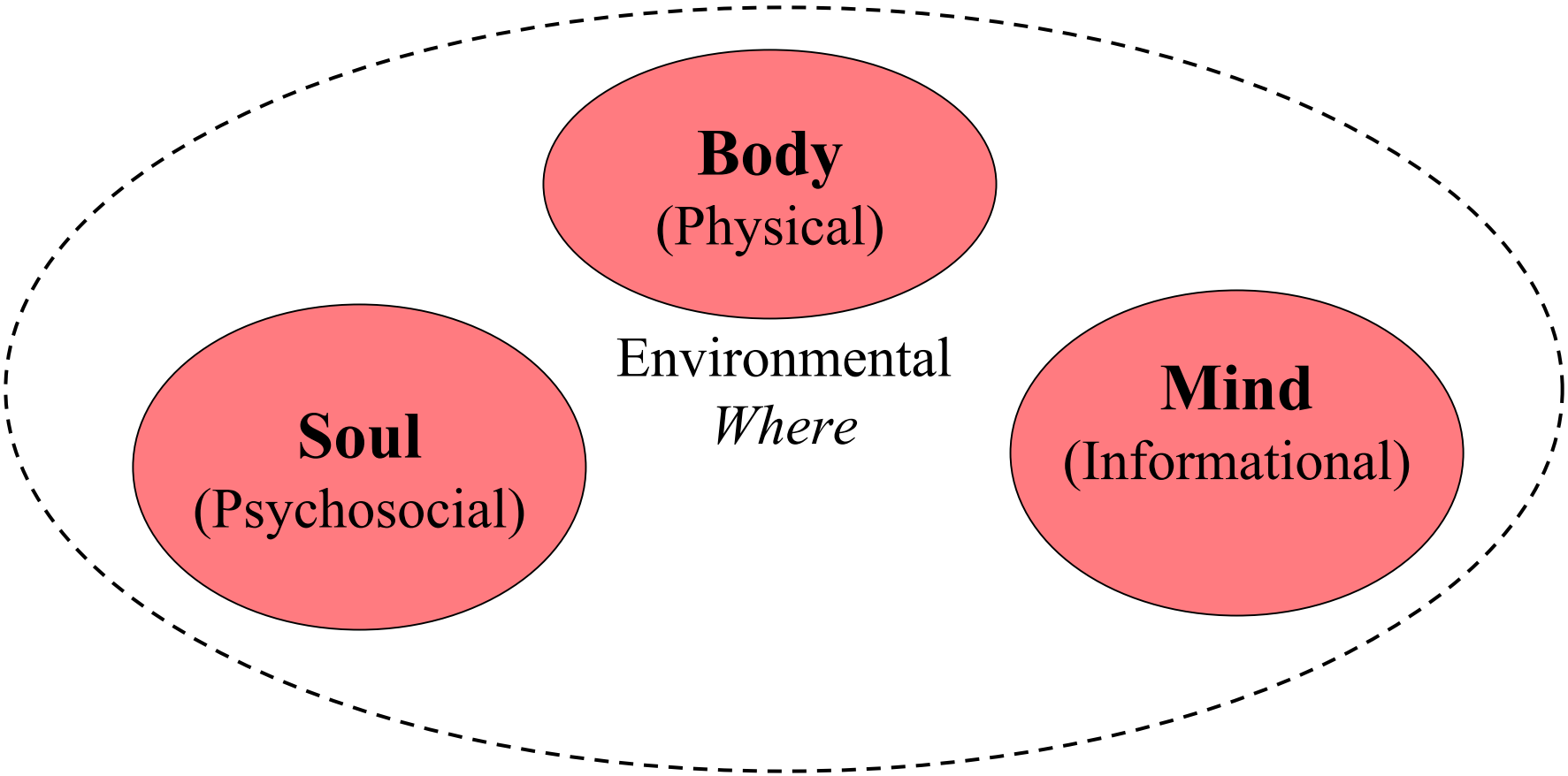
More on the **Why**

All the ***outcomes*** *are related*



Comfort, Convenience and Performance

Back to **What**



They all come in the same package - Human Factors addresses all these factors with appropriate analysis tools, decision rules and design requirements

Food for the soul

How

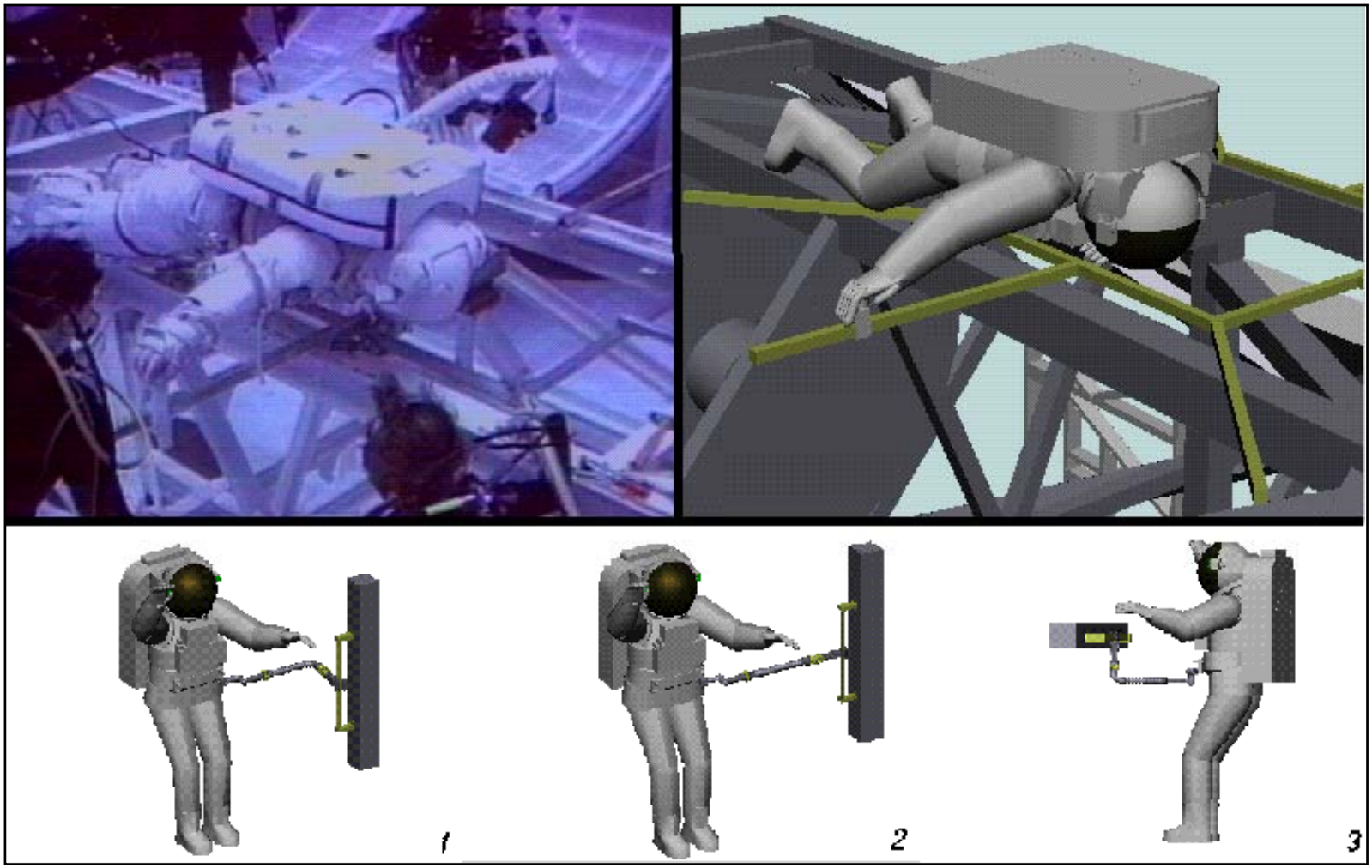
We **contribute to the decisions** regarding the choices between alternative intervention or design strategies

We **participate in the design** and intervention process

We **evaluate** the results of our recommendations

We study (**analyze**) the interactions between people (individuals, groups and populations) and their natural, simulated or designed environments to establish relationships between these conditions and desirable or undesirable outcomes

Digital Human modeling is as effective as and less expensive than physical mockups.



More on **How** We Analyze

What

We carry out analysis of human interactions with their physical, cognitive and psychosocial environments at various levels of precision:

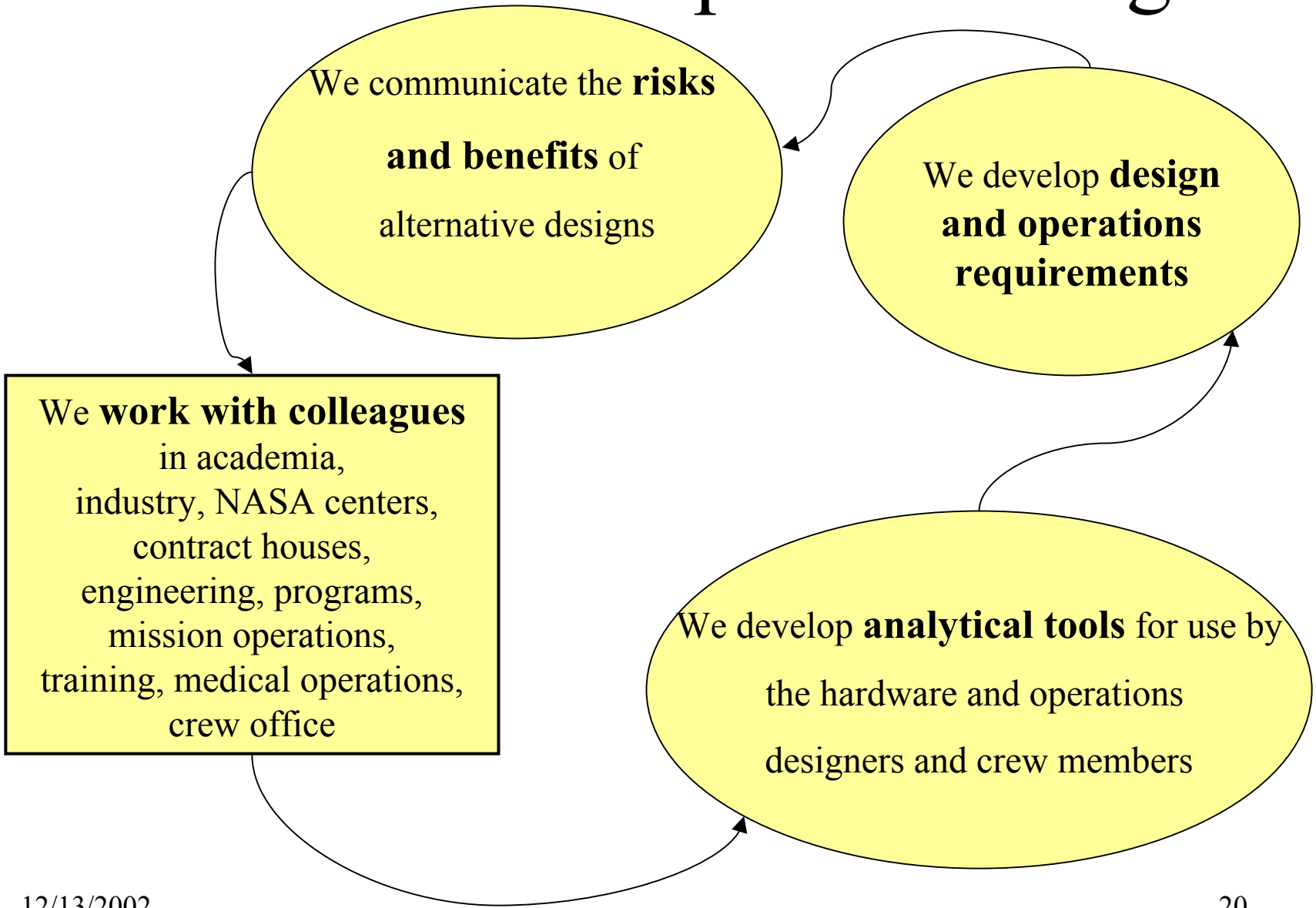
- Surveys and checklists
- Task and performance analyses
- Formal experimentation

Where

- The laboratory
- Simulators
- Analogs
- The real context under controlled conditions
- The real context under real conditions

Don Doff Study on the KC 135

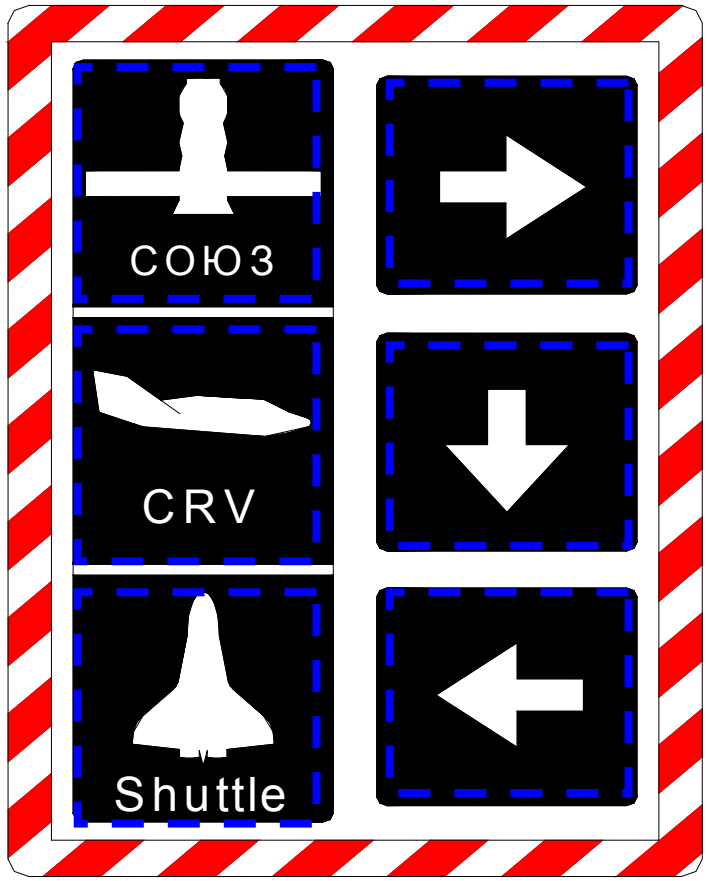
How Do We Participate in Design?



What Can We Design?

- Work, rest, exercise, personal and recreation facilities
- Postural restraints and motion assists
- Clothing
- Environments
- Equipment and equipment interfaces
- Information systems and computer interfaces
- Communication systems
- Tools
- Tasks
- Procedures
- Instructions, warnings, labels and job aids
- Work - rest schedules
- Command and control arrangements

and much more

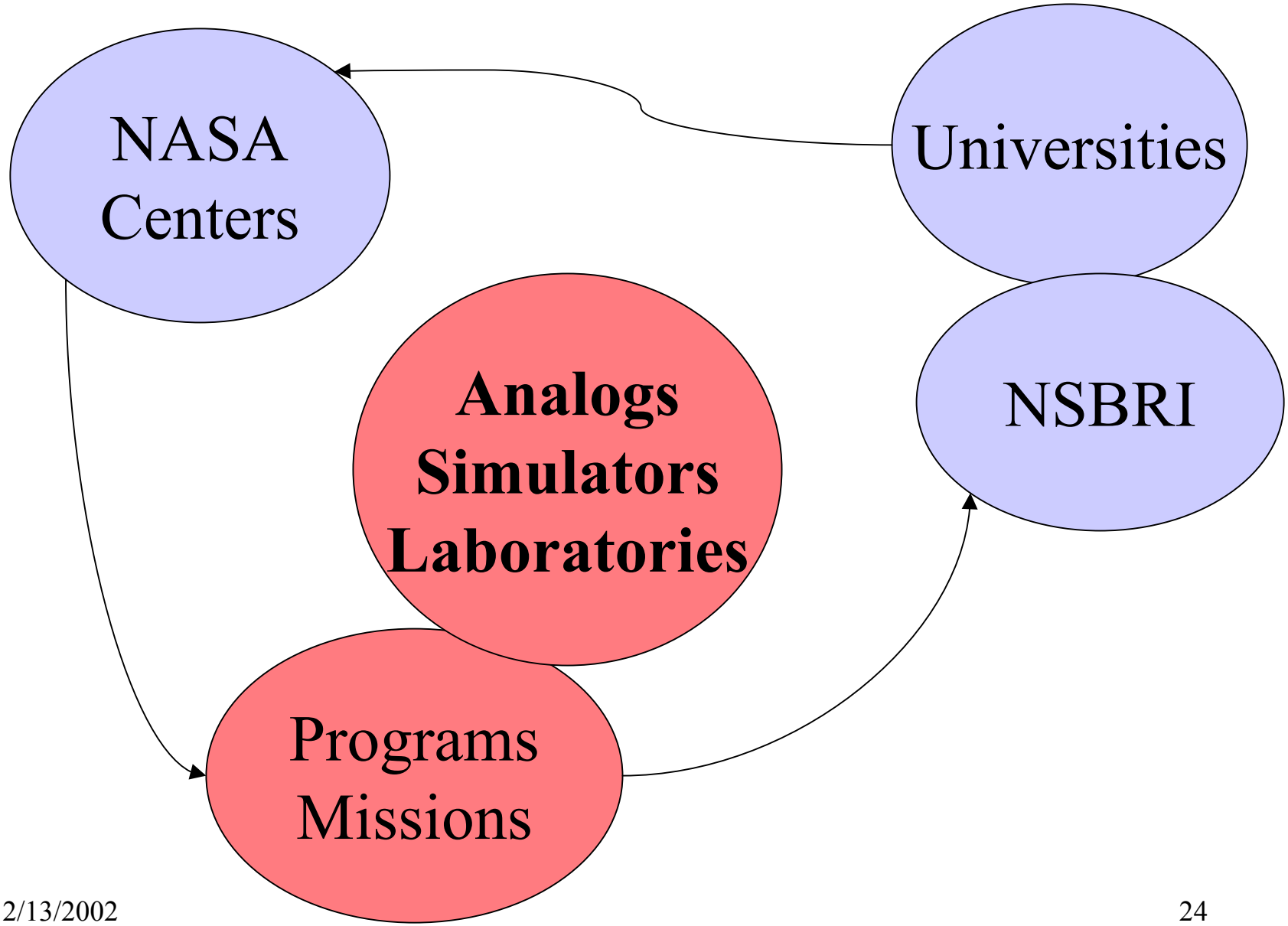


Which way is up?
Which way is out?

Who

SHFE is gregarious – we have many customers and colleagues – the crew members, astronaut office, program office, engineers, medical specialists, contractors, mission planners and controllers, professional and academic colleagues, management policy makers, researchers.

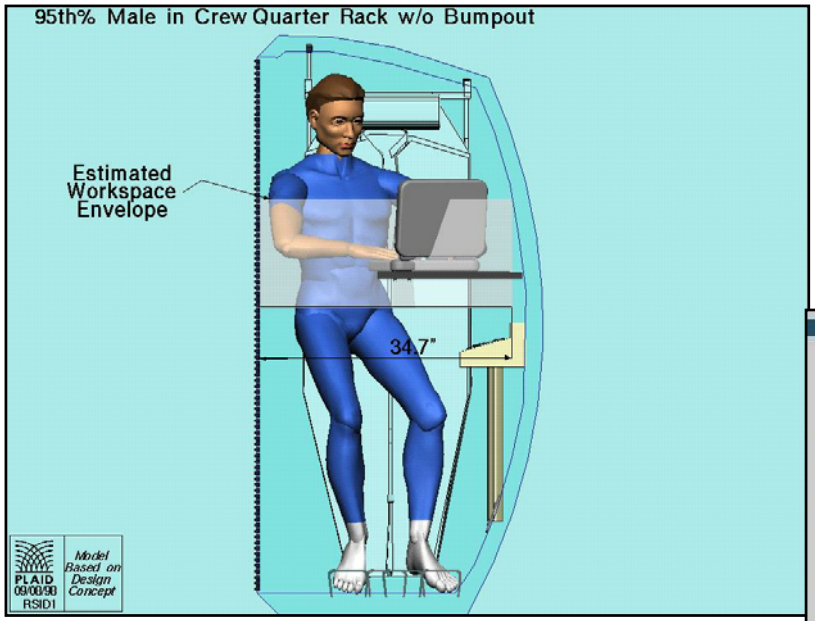
Where

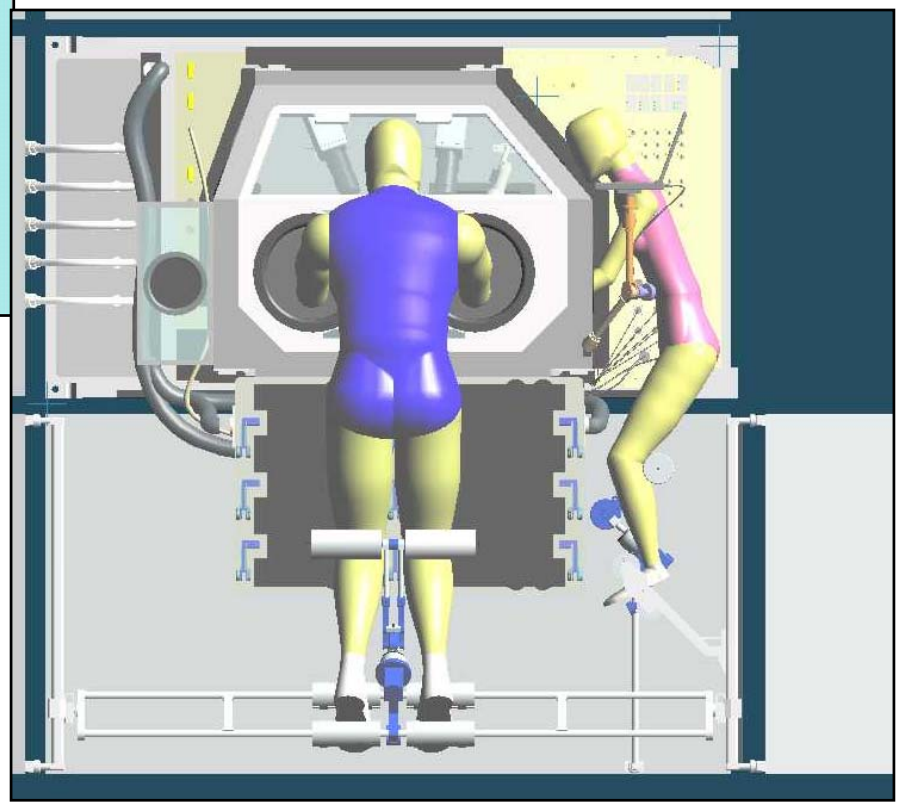

NASA Centers
Universities
Analogs
Simulators
Laboratories
NSBRI
Programs
Missions

Some Specific **Whats**

- **Rule based indices** of habitability, effectiveness, efficiency, and safety
- **Some low hanging fruit** – the simulators, analogs and trainers – they all have a lot to offer
- **The medical community** – they are asking our help
- **The engineers** – they need clear requirements, analysis tools and training
- **The operations community** – they too need clear requirements, analysis tools and training
- **Modeling** is where it's at – anthropometric, biomechanical, environmental, cognitive, communication, psycho-social, temporal, situational

More Models


95th% Male in Crew Quarter Rack w/o Bumpout
Estimated Workspace Envelope
34.7"
PLAID 08/00/SD RSID1
Model Based on Design Concept



Where Are Our Weaknesses?

- A coherent **toolbox** of analysis devices
  - We rely too much on "professional opinion" which is open to debate by all who have different motives
- Agreed upon **decision rules** and processes
- A useful and usable set of **design requirements**
- A need to address the **time dimension** in our activities
- **Success stories**
- A comprehensive **lessons learned** database
- **Communication** with our professional colleagues in the universities and other NASA centers
- An **organization design** that formally addresses customer interfaces and requirements